

MONTHLY WEATHER REVIEW.

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INTRODUCTION.

In this REVIEW are shown the general meteorological conditions which prevailed over the United States during May, 1883. The tracks of the storms which have occurred in the north Atlantic ocean during the month, are approximately shown on chart ii., and are described under the heading "North Atlantic Storms." On this chart are also shown the limits within which ice was observed in the north Atlantic ocean.

The following are the special meteorological features of the month:

1st.—The mean temperature, which has been below the normal in nearly all parts of the country; the departures being most marked in the extreme northwest, upper Mississippi and Missouri valleys, where they have averaged $6^{\circ}.5$. As a noteworthy feature, in this connection may be mentioned, that over a large extent of country where marked departures below the normal temperature have occurred, the mean atmospheric pressure has also been below the normal.

2d.—The large excess over the average rainfall in the lower lake region, Missouri valley, south Atlantic states, and in California. In the latter state the rainfall for the month has been more than four times as great as the average for May.

3d.—The violent and destructive local storms which occurred on the 13th, in Kansas and Missouri; and on the 18th, in Wisconsin, Illinois and Indiana.

4th.—The heavy frosts which occurred on the 22d, in the western states, resulting in serious injury to various kinds of vegetation, especially in the states of Illinois and Missouri.

In the preparation of this REVIEW, the following data, received up to June 20th, have been used; viz.: the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-one Signal-Service stations and fourteen Canadian stations, as telegraphed to this office; one hundred and sixty-nine monthly journals, and one hundred and sixty-eight monthly means from the former, and fourteen monthly means from the latter; two hundred and thirty-three monthly registers from voluntary observers; fifty monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports, through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs, furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Illinois, Indiana, Iowa, Nebraska, New Jersey and Tennessee, and of the Central Pacific railway company; trustworthy newspaper extracts; and special reports.

BAROMETRIC PRESSURE.

[Expressed in inches and hundredths.]

The distribution of mean atmospheric pressure for the month of May, 1883, determined from the tri-daily telegraphic obser-

vations of the Signal Service, is shown by the isobarometric lines, in red, on chart iii.

The area of least mean pressure is inclosed by the isobar of 29.85 and occupies about the same position as that of the preceding month. It is, however, more extended than the low area of April, and embraces a region stretching southwestward from southeastern Wyoming, and the western portions of Nebraska and Kansas, to beyond the limits of the Signal-Service stations.

The regions of greatest mean pressure are the north Pacific coast region; along the immediate California coast; over the south Atlantic and east Gulf states, and in eastern Nova Scotia. In these districts the monthly barometric means exceed 30.0, the maximum mean pressure for the month occurring over the south Atlantic and east Gulf states, and in the north Pacific coast region. The mean pressure of May, compared with that of April, shows an increase over the northern plateau and north Pacific coast regions, varying from .01 to .04. The pressure is also greater in Nova Scotia, the Gulf states, Tennessee, and in the lower Missouri valley. In these districts the increase is generally less than .05, the only exceptions being .06 at Galveston and Indianola, Texas, and .07 at Sydney, Nova Scotia. In all other districts the mean pressure is below that of April. The largest deficiencies occur in central California, and in the lower lake region. At Sacramento, California, a decrease of .11 has taken place; at other stations where deficiencies have occurred they are less marked.

DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

The mean pressure of May is slightly above the normal over the southwestern part of the country, from the Mississippi river to the Pacific coast. It is also above the normal in Florida, the upper Missouri valley, northern slope, and middle plateau. In these districts the deficiencies are uniformly slight, except in the upper Missouri valley, at Forts Buford and Stevenson, Dakota, where they are .12 and .09, respectively. In the north Pacific coast region, middle slope, lower Missouri valley, and in all districts east of the Mississippi river, except in Florida, the pressure is below the normal. The deficiencies are greatest in the lake region and in the middle and south Atlantic states, where they are generally from .06 to .09.

BAROMETRIC RANGES.

The monthly barometric ranges have been greatest between the ninety-fifth and one-hundred and fifth meridians north of the thirty-seventh parallel of latitude, where they have exceeded 1.00, the largest, 1.19, being reported from Huron, Dakota.

The smallest monthly ranges occurred in southern California and in Arizona, 0.27 being reported from San Diego, California, and 0.31 from Fort Grant, Arizona, and Los Angeles, California.

In the several districts the monthly ranges have varied as follows:

New England.—From 0.74 on the summit of Mount Washington, New Hampshire, to 0.95 at Eastport, Maine.

Middle Atlantic states.—From 0.83 at Albany, New York, to 0.99 at Baltimore, Maryland, and Washington, District of Columbia.

South Atlantic states.—From 0.64 at Jacksonville, Florida, to 0.87 at Wilmington, North Carolina.

Florida peninsula.—From 0.41 at Key West, to 0.61 at Sanford.

Eastern Gulf.—From 0.48 at New Orleans, Louisiana, to 0.57 at Montgomery, Alabama.

Western Gulf.—From 0.41 at Galveston, Texas, to 0.68 at Fort Smith, Arkansas.

Ohio valley and Tennessee.—From 0.59 at Memphis, Tennessee, to 0.95 at Pittsburg, Pennsylvania.

Lower lakes.—From 0.69 at Rochester, New York, to 0.82 at Cleveland, Ohio.

Upper lakes.—From 0.64 at Port Huron, Michigan, to 0.94 at Duluth, Minnesota.

Extreme northwest.—From 0.94 at Saint Vincent, Minnesota, to 1.11 at Moorhead, Minnesota.

Upper Mississippi valley.—From 0.67 at Cairo, Illinois, to 1.01 at Saint Paul, Minnesota.

Missouri valley.—From 0.92 at Leavenworth, Kansas, to 1.19 at Huron, Dakota.

Northern slope.—From 0.71 at Fort Assiniboine, Montana, to 1.07 at North Platte, Nebraska.

Middle slope.—From 0.78 on the summit of Pike's Peak, Colorado, to 1.02 at West Las Animas, Colorado.

Southern slope.—From 0.48 at Fort Concho, Texas, to 0.58 at Fort Stockton, Texas.

Southern plateau.—From 0.33 at Tucson, Arizona, to 0.64 at Santa Fé, New Mexico.

Middle plateau.—From 0.59 at Pioche, Nevada, to 0.72 at Salt Lake City, Utah.

Northern plateau.—From 0.85 at Spokane Falls, Washington Territory, to 0.94 at Lewiston, Idaho.

North Pacific.—From 0.70 at Roseburg, Oregon, to 0.75 at Portland, Oregon, and Olympia, Washington Territory.

Middle Pacific.—From 0.53 at Sacramento, California, to 0.67 at Cape Mendocino, California.

South Pacific.—From 0.27 at San Diego, California, to 0.54 at Visalia, California.

AREAS OF HIGH BAROMETER.

The high pressures for the month have not been of great extent or long duration, and have not been associated with any great climatic changes. In this connection attention may be invited to the fact before stated, that the pressure for the month is generally below the mean. Five areas of high barometer have been described. These have been accompanied by low areas, and the high pressures probably resulted from the vertical circulation of the air from the centres of depression in their immediate vicinity. The mean direction of the tracks of high pressures has been very nearly from the west to the east, which is the usual path for the month of May.

The minimum temperatures for the month do not appear to have been specially associated with these areas, with the exception of the north Atlantic coast, where the lowest temperatures were reported on the morning of the 1st in connection with high area i.

I.—The high area described as viii. in the April REVIEW was on the 1st central in the New England states and maritime provinces of Canada, where the pressure was from 0.3 to 0.5 inches above the mean. At the morning observation of the 2d, the isobar of 30.5 inches included all of Nova Scotia and a great portion of the Gulf of Saint Lawrence. During the day the high barometer moved slowly to the eastward beyond the limits of the chart. During its prevalence fair weather and light winds were reported from New England.

II.—On the 1st, the pressure was high in Manitoba, while a depression was developing in Colorado and Nebraska. Brisk to high northeasterly winds were reported from Minnesota and Dakota. On the 2d, the high area extended over the Lake Superior region, and high northeast winds were reported from upper lakes. On the 3d, the pressure was generally above the mean in Canada, but it ceased to exercise any marked influences.

III.—On the 4th, there was a slight increase of pressure in Missouri and Iowa, in rear of low area i. On the 5th, the high pressure, accompanied by fair weather and northwest-

erly winds, extended over the Ohio valley. On the 6th, the high area was transferred to the middle Atlantic coast in advance of low area iii., then moving over the northwest. On the 7th, the highest barometers were reported from the south Atlantic and east Gulf states, accompanied by southerly winds and high temperatures.

IV.—On the 9th, while low area iv. was moving over Nebraska and Iowa, there was a considerable rise of pressure in Manitoba. On the 10th, the high barometer extended to the southward, the rise at Omaha and Des Moines exceeding 0.7 inch. On the 11th, the high area covered the country from Manitoba to the Ohio valley. On the 12th, the highest pressures were reported from Minnesota and the upper lake region. On the 13th and 14th, the centre of high area was rapidly transferred to the eastward beyond the middle Atlantic coast in advance of low area v., moving over the Ohio valley and lake region.

V.—On the 14th, there was a considerable rise in the mercury in the upper Missouri valley and Minnesota in rear of low area v. On the 15th, accompanied by clearing weather and northwest winds, the high area became central in Missouri and Illinois. On the 16th, the high pressure extended from the lake region to the east Gulf and the south Atlantic coast. On the 17th, the highest barometers were reported from the middle states. On the 18th, the centre of high area was transferred to the maritime provinces of Canada, where the pressure was about 0.4 inch above the mean for the month. On the 19th, this area moved beyond the limits of the chart in advance of low area vi., then moving over the lake region.

AREAS OF LOW BAROMETER.

Nine areas of low barometer have been charted for the month of May. Chart i. exhibits the paths of the centres of these areas as determined from the tri-daily weather reports of this service.

The following table gives the latitudes and longitudes in which each depression was first and last observed, and the average hourly velocity of each depression:

Areas of low barometer.	FIRST OBSERVED.		LAST OBSERVED.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.	40 00	106 30	46 00	80 00	20.5
II.	31 00	81 00	34 30	75 00	17.0
III.	41 00	107 00	49 30	64 30	39.3
IV.	39 30	104 30	46 00	73 00	25.6
V.	40 30	102 00	40 00	74 30	27.2
VI.	39 30	105 30	50 00	64 00	24.5
VII.	34 30	92 00	47 00	59 00	17.3
VIII.	38 00	101 00	48 00	95 30	43.1
IX.	31 30	101 00	46 30	70 30	54.7
Mean hourly velocity.....					30.0

As no meteorological observations taken west of the Rocky mountains were telegraphed during the month to this office, no tracks of low area can be charted from the Pacific slope. Of these depressions it is worthy of remark, that six, numbers i., iii., iv., v., vi., and viii. were first noted in nearly the same region. The origin of number ii. is obscure; it may have developed where first charted or the track may be the northern path of a tropical hurricane after recurving to the eastward.

I.—On the 1st, a storm-centre developed in Colorado, which, on the 2d, slowly pursued an easterly track into Iowa and Missouri. Fair weather with warm southerly winds was reported from the south and east quadrants, and rain with cold northeasterly winds from the north and west quadrants. On the 3d, with a great diminution of storm energy, the depression became central in Indian. On the 4th, the low area was central in the region of Lake Erie, and on the 15th, increasing slightly in energy, it moved to the northward beyond Lake Huron. Cautionary signals displayed at southern ports of Lake Michigan and on Lake Erie were justified by the following maximum velocities: Milwaukee, 37, ne.; Toledo, 27, e.

II.—The afternoon observation of the 1st showed that since the morning report a storm of considerable energy had developed at sea near the south Atlantic coast. At the midnight ob-

servation the fall of the barometer and the circulation of the winds showed that the centre was southeast of Charleston. On the 2d, the storm pursued with great energy its northeasterly course, passing beyond the North Carolina coast. At no time was the storm-centre within the limits of the land stations of this service. At this date marine reports are missing which might show where the storm originated. The following maximum velocities were reported from Savannah and Charleston, respectively, 36, n., and 41, ne. Cautionary signals were displayed from Smithville to Sandy Hook, and the following are the reported maximum velocities: Smithville, 35, ne.; Macon, 46, nw.; Hatteras, 56, ne.; Kittyhawk, 43, ne.; Cape Henry, 28, ne.; Chincoteague, 30, ne.; Delaware Breakwater, 33, ne.; Cape May, 26, ne.; Barnegat City, 25, e.

III.—At the midnight observation of the 5th a depression was developed in western Colorado, which, on the 6th, increasing considerably in energy, moved in a northeasterly track over the northwest. On the 7th, the storm-centre advanced rapidly over the lake region into the Saint Lawrence valley, passing on the 8th beyond the Gulf of Saint Lawrence. As is not unusual in May storms, very little rain fell to the south of the track of the centre of low area, the precipitation being generally confined to the north and west quadrants. Although not a severe storm, cautionary signals were displayed on Lakes Superior and Michigan, and the following maximum velocities were reported: Grand Haven, 25, s.; Duluth, 28, ne.

IV.—On the 8th, a storm exhibiting considerable energy, appeared in Colorado. On the 9th, the centre of depression moved to the eastward into Iowa accompanied by heavy rains and high winds. On the 10th, the storm had advanced over the lake region, and general rain fell as far south as the Gulf of Mexico. On the 11th, the storm-centre moved to the northeast, beyond the limits of the stations of observations. During the progress of this storm to the eastward, rain fell at nearly all the stations east of the Rocky mountains. Cautionary signals were displayed in advance of this storm on Lakes Michigan, Huron, and Erie, and were generally justified by the following maximum velocities: Escanaba, 33, ne.; Milwaukee, 31, se.; Grand Haven, 32, nw.; Mackinaw City, 52, e.; Alpena, 27, nw.; Port Huron, 29, nw.; Toledo, 32, sw.; Cleveland, 29, s.; Erie, 25, s.; Buffalo, 30, sw.

V.—On the 13th, a storm-centre, exhibiting considerable force, moved to the eastward over Colorado and Nebraska. On the 14th, increasing in energy, it advanced into Ohio. At the morning observations of this day the pressures in Iowa were from 0.5 to 0.6 inch below the normal. On the 15th, with a great diminution of energy, the centre of low area was transferred beyond the middle Atlantic coast. Cautionary signals were displayed for this storm on all the lakes, except Lake Ontario. The following are the maximum velocities: Duluth, 28, ne.; Milwaukee, 25, se.; Grand Haven, 29, ne.; Detroit, 28, ne.; Toledo, 40, n.; Cleveland, 28, n.

VI.—On the 17th, a very severe storm-centre, moving to the northeastward, appeared in Colorado. At the midnight observation the following low-pressures were reported: North Platte, and Yankton, 29.16; Omaha, 29.22; or all lower than 0.7 inch below the normal. On the 18th, the storm-centre, increasing in energy, moved into Minnesota. At the morning report the barometer at Yankton, 29.12, was 0.81 inches below the normal. On the 19th, the storm continued very severe as its centre moved over the upper lake region. On the 20th, the low area moved in an easterly track into the Saint Lawrence valley and disappeared the next day beyond the gulf of that name. This storm is especially notable for the high winds that appeared in the lake region after the passage of the centre of low area, and also for the development of a secondary depression (vii.) in Arkansas. For this storm, cautionary signals were displayed on all the lakes, except Lake Ontario, and were generally justified by the following maximum velocities: Duluth, 33, ne. and 28, nw.; Marquette, 33, s.; Chicago, 32, sw.; Milwaukee, 45, w.; Grand Haven, 37, s.; Detroit, 40, s.; Toledo, 32, sw.; Cleveland, 28, n.

VII.—As stated in the description of low area vi., vii. was a subsidiary development from the former depression. At the midnight observation of the 19th, low area vi. was central north of Lake Huron, with the pressure rising in the upper lake region, the northwest, and thence to the Rio Grande valley. At the same time there was a decided fall of pressure in Arkansas. The morning observation of the 20th, showed a fall in pressure of 0.29 inch at Memphis. In the afternoon the lowest barometer, 29.52, was at Nashville; at the same time a great trough-like depression extended from the mouth of the Saint Lawrence river to Tennessee. At midnight the pressure in Virginia and North Carolina was, in general, 0.5 inch below the normal. On the 21st and 22d, the storm-centre, moving slowly to the northeastward, remained in the middle Atlantic states. High northerly winds with cold rains were reported from the lake region. On the 23d and 24th, diminishing in energy, the low area moved along and beyond the New England coast. Cautionary signals were displayed from Hatteras to Eastport, and the following maximum velocities registered: Hatteras, 36, sw.; Kittyhawk, 38, sw.; Delaware Breakwater, 33, se.; Cape May, 28, se.; Barnegat City, 33, s.; Sandy Hook, 38, e.; Block Island, 26, s.; Eastport, 40, ne.

VIII.—At the midnight observation of the 27th, a considerable depression was central in Kansas. On the 28th, it moved in an easterly path into Ohio, but without developing any special storm energy. On the 29th, the low area moved to the northeastward into the Gulf of Saint Lawrence. No cautionary signals were displayed for this low area.

IX.—On the 29th, the pressure was low in Texas, with light and variable winds. On the 30th, the low area, developing greatly in energy, moved very rapidly in a northeasterly track to the lower lake region. On the 31st, the storm-centre moved beyond the limits of the observing stations. Cautionary signals were displayed for this storm from Delaware Breakwater to Eastport, and were generally justified by the following velocities: Delaware Breakwater, 32, s.; Cape May 32, s.; Barnegat City, 29, sw.; Sandy Hook, 27, se.; New London, 25, s.; Block Island, 28, s.; Provincetown, 27, sw.; Thatcher's Island, 26, s.; Eastport, 28, se.

NORTH ATLANTIC STORMS DURING MAY, 1883.

[Pressure expressed in inches and in millimetres; wind-force by scale of 0—10.]

Chart ii. exhibits the tracks of the principal depressions that have moved over the north Atlantic ocean during May, 1883. The location of the various storm-centres has been approximately determined from reports of observations furnished by agents and captains of ocean steamships and sailing vessels in the north Atlantic, and from other miscellaneous data received at this office up to June 21st. The observations used are, in general, simultaneous, being taken each day at 7 h. 0 m. a. m., Washington, or 0 h. 8 m. p. m., Greenwich mean time.

Of the five depressions shown on the chart, only one, v., has been traced as a continuous storm from the North American continent northeastward to the British coasts. Two depressions apparently developed over the ocean near the fiftieth parallel, both moving in a northeasterly direction. The depressions i. and iv., after leaving the coast of the United States, filled up apparently west of the fiftieth meridian. Low area iii. was remarkable for the unusual depth, at this season of the atmospheric depression, and for the absence of the violent winds and stormy weather commonly associated with such depressions.

The weather over the north Atlantic during the month was generally fair, but dense fogs prevailed over the region west of the fortieth meridian almost uninterruptedly throughout the month. The atmospheric pressure was, in general, high.

The following are brief descriptions of the depressions traced on the chart.

I.—This was probably a continuation of the disturbance traced as low area ii. of chart i. During its passage northeastward along the coast of the Carolinas, it displayed great energy and several vessels sustained loss of spars and sails.